

CLAIMS

1. A substrate cleaning method which comprising:
performing a rinse process on a substrate to be processed
with pure water supplied to a surface thereof while
5 rotating the substrate in a substantially horizontal
state; and thereafter performing a spin dry process on
the substrate while forming a liquid film in a
substantially outer region of a pure-water feed point to
the substrate by making a feed amount of the pure water
10 to the substrate smaller than that at a time of the rinse
process and moving said pure-water feed point to the
substrate outward from a center of the substrate.

2. The substrate cleaning method according to claim
1, wherein in said spin dry process, a speed of moving
15 the pure-water feed point to the substrate outward from
the center of the substrate is made faster at an outer
peripheral portion of the substrate than at the center
portion thereof.

3. The substrate cleaning method according to claim
20 1 or 2, wherein in said spin dry process, when the pure-
water feed point to the substrate reaches a position
separated from the center of the substrate by a
predetermined distance, movement of said pure-water feed
point is temporarily stopped, and a nitrogen gas is
25 sprayed to the center portion of the substrate, after
which spraying of said nitrogen gas is stopped and said
pure-water feed point is moved out of the substrate again.

4. The substrate cleaning method according to claim 3, wherein in said spin dry process, the pure-water feed point to the substrate is rapidly moved to a position separated from the center of the substrate by 10 to 15 mm, where movement of said pure-water feed point is temporarily stopped, and a nitrogen gas is sprayed to the center portion of the substrate for a predetermined time, after which spraying of said nitrogen gas is stopped and said pure-water feed point is moved out of the substrate again at a speed equal to or less than 3 mm/second.

5. The substrate cleaning method according to claim 1 or 2, wherein in said spin dry process, after the pure-water feed point to the substrate is shifted from the center of the substrate by a predetermined distance, a nitrogen gas is sprayed to the center portion of the substrate, after which a spray point of said nitrogen gas is moved, together with said pure-water feed point, outward from the center portion of the substrate while spraying the nitrogen gas to the substrate.

6. The substrate cleaning method according to claim 5, wherein in said spin dry process, only spraying of the nitrogen gas is stopped while moving the spray point of said nitrogen gas, together with said pure-water feed point, outward from the center portion of the substrate.

7. The substrate cleaning method according to claim 5 or 6, wherein a number of rotations of the substrate in said rinse process is set equal to or greater than 100

rpm and equal to or less than 1000 rpm, and a number of rotations of the substrate in said spin dry process is set equal to or greater than 800 rpm and equal to or less than 2500 rpm.

5 8. The substrate cleaning method according to any one of claims 1 to 6, wherein a number of rotations of the substrate at a time of the spin dry process is set greater than a number of rotations of the substrate at a time of the rinse process.

10 9. The substrate cleaning method according to claim 8, wherein a number of rotations of the substrate in said rinse process is set equal to or greater than 100 rpm and equal to or less than 1000 rpm, and a number of rotations of the substrate in said spin dry process is set equal to
15 or greater than 1500 rpm and equal to or less than 2500 rpm.

 10. The substrate cleaning method according to any one of claims 1 to 9, wherein a mixture of a hydrophobic surface and a hydrophilic surface exists on the surface
20 of the substrate.

 11. A substrate cleaning apparatus comprising:
 a spin chuck which holds and rotates a substrate to be processed in a substantially horizontal state;
 a pure-water supply mechanism having a pure-water
25 supply nozzle which discharges pure water to a surface of the substrate held by said spin chuck, and a pure-water supply section which supplies the pure water to said

pure-water supply nozzle;

a pure-water nozzle scan mechanism which causes said pure-water supply nozzle to scan between above a center of the substrate and above an outer edge thereof; and

5 a control section which controls said spin chuck, said pure-water supply mechanism and said pure-water nozzle scan mechanism in such a way as to perform a rinse process of feeding the pure water to a surface of the substrate at a predetermined flow rate while rotating the substrate held by said spin chuck,
10 and then perform a spin dry process on the substrate while forming a liquid film in a substantially outer region of a pure-water feed point to the substrate by making a feed amount of the pure water to the substrate smaller than that at a time of the rinse process and
15 moving said pure-water feed point to the substrate outward from a center of the substrate.

12. The substrate cleaning apparatus according to claim 11, wherein in said spin dry process, said control
20 section makes a speed of moving the pure-water feed point outward from the center of the substrate faster at an outer peripheral portion of the substrate than at the center portion thereof.

13. The substrate cleaning apparatus according to claim 11 or 12, further comprising a gas supply mechanism
25 having a gas nozzle which sprays a nitrogen gas to a center portion of the surface of the substrate held by

said spin chuck, and

wherein said control section further controls said gas supply mechanism in such a way that in said spin dry process, when the pure-water feed point to the substrate reaches a position separated from the center of the substrate by a predetermined distance, movement of said pure-water feed point is temporarily stopped, and a nitrogen gas is sprayed to the center portion of the substrate, then said pure-water feed point is moved out of the substrate again after spraying of said nitrogen gas is stopped.

14. The substrate cleaning apparatus according to claim 13, wherein, said control section, in said spin dry process, rapidly moves the pure-water feed point to the substrate to a position separated from the center of the substrate by 10 to 15 mm, stops movement of said pure-water feed point there, subsequently sprays a nitrogen gas to the center portion of the substrate for a predetermined time, and then stops spraying said nitrogen gas and moves said pure-water feed point out of the substrate again at a speed equal to or less than 3 mm/second.

15. The substrate cleaning apparatus according to claim 11 or 12, further comprising a gas supply mechanism having a gas nozzle which sprays a nitrogen gas to the surface of the substrate held by said spin chuck, and a gas nozzle scan mechanism which causes said gas nozzle to

scan on the target substrate, and

wherein said control section further controls said gas supply mechanism and said gas nozzle scan mechanism in such a way that in said spin dry process, after the
5 pure-water feed point to the substrate is shifted from the center of the substrate by a predetermined distance, a nitrogen gas is sprayed to the center portion of the substrate, then a spray point of said nitrogen gas is moved, together with said pure-water feed point, outward
10 from the center portion of the substrate while spraying the nitrogen gas to the substrate.

16. The substrate cleaning apparatus according to claim 15, wherein, said control section, in said spin dry process, stops only spraying of the nitrogen gas while
15 moving the spray point of said nitrogen gas, together with said pure-water feed point, outward from the center portion of the substrate.

17. The substrate cleaning apparatus according to claim 11 or 12, further comprising a gas supply mechanism
20 having a gas nozzle which sprays a nitrogen gas to the surface of the substrate held by said spin chuck, and

wherein said gas nozzle is held apart from said pure-water supply nozzle by a given space by said pure-water nozzle scan mechanism, and

25 said control section further controls said gas supply mechanism in such a way that in said spin dry process, after the pure-water feed point to the substrate

is shifted from the center of the substrate by a predetermined distance, a nitrogen gas is sprayed to the center portion of the substrate, then a spray point of said nitrogen gas and said pure-water feed point are simultaneously moved outward from the center portion of the substrate while spraying the nitrogen gas to the substrate.

18. The substrate cleaning apparatus according to any one of claims 15 to 17, wherein said control section sets a number of rotations of the substrate in said rinse process equal to or greater than 100 rpm and equal to or less than 1000 rpm, and sets a number of rotations of the substrate in said spin dry process equal to or greater than 800 rpm and equal to or less than 2500 rpm.

19. The substrate cleaning apparatus according to any one of claims 11 to 17, wherein said control section sets a number of rotations of the substrate at a time of the spin dry process greater than a number of rotations of the substrate at a time of the rinse process.

20. The substrate cleaning apparatus according to claim 19, wherein said control section sets a number of rotations of the substrate in said rinse process equal to or greater than 100 rpm and equal to or less than 1000 rpm, and sets a number of rotations of the substrate in said spin dry process equal to or greater than 1500 rpm and equal to or less than 2500 rpm.

21. A computer readable recording medium having

recorded a program for allowing a computer that controls a substrate cleaning apparatus, which performs a rinse process by supplying pure water to a substrate to be processed while rotating the substrate held in an
5 approximately horizontal state, to execute a process of (a) performing a rinse process of feeding the pure water to a surface of the substrate at a predetermined flow rate while rotating the substrate held by said spin chuck, and (b) performing spin dry on the substrate while
10 forming a liquid film in a substantially outer region of a pure-water feed point to the substrate by making a feed amount of the pure water to the substrate smaller than that at a time of said rinse process and moving said pure-water feed point to the substrate outward from a
15 center of the substrate.

22. The computer readable recording medium according to claim 21, wherein said program causes said computer to control said substrate cleaning apparatus in such a way that a speed of moving the pure-water feed point to the
20 substrate outward from the center of the substrate is made faster at an outer peripheral portion of the substrate than at the center portion thereof.

23. A computer readable recording medium having recorded a program for allowing a computer that controls
25 a substrate cleaning apparatus, which performs a rinse process by supplying pure water to a substrate to be processed while rotating the substrate held in an

approximately horizontal state, and further performs spin dry by feeding a nitrogen gas to the substrate, to execute a process of (a) performing a rinse process of feeding the pure water to a surface of the substrate at a predetermined flow rate while rotating the target substrate held by said spin chuck, (b) making a feed amount of the pure water to the substrate smaller than that at a time of said rinse process and moving a pure-water feed point to the substrate outward from a center of the substrate, (c) when the pure-water feed point to the substrate reaches a position separated from the center of the substrate by a predetermined distance, temporarily stopping movement of said pure-water feed point, and spraying a nitrogen gas to the center portion of the substrate, and (d) after spraying of said nitrogen gas is stopped, said pure-water feed point is moved out of the substrate again, thereby performing spin dry on the substrate while forming a liquid film in a substantially outer region of said pure-water feed point.

24. The computer readable recording medium according to claim 23, wherein said program causes said computer to control said substrate cleaning apparatus in such a way that in said process (b), the pure-water feed point to the substrate is rapidly moved outward from the center of the substrate, in said process (c), movement of the pure-water feed point is stopped at a position separated from the center of the substrate by 10 to 15 mm, and a

nitrogen gas is sprayed to the center portion of the substrate for a predetermined time, and in said process (d), after spraying of said nitrogen gas is stopped, the pure-water feed point is moved out of the substrate again
5 at a speed equal to or less than 3 mm/second.

25. A computer readable recording medium having recorded a program for allowing a computer that controls a substrate cleaning apparatus, which performs a rinse process by supplying pure water to a substrate to be
10 processed while rotating the target substrate held in a substantially horizontal state, and further performs spin dry by feeding a nitrogen gas to the substrate, to execute a process of (a) performing a rinse process of feeding the pure water to a surface of the substrate at a
15 predetermined flow rate while rotating the substrate held by said spin chuck, (b) making a feed amount of the pure water to the substrate smaller than that at a time of said rinse process and moving a pure-water feed point to the substrate outward from a center of the substrate, (c)
20 when the pure-water feed point to the substrate reaches a position separated from the center of the substrate by a predetermined distance, temporarily stopping movement of said pure-water feed point, and spraying a nitrogen gas to the center portion of the substrate, and (d) a spray
25 point of said nitrogen gas is moved, together with said pure-water feed point, outward from the center portion of the substrate while spraying the nitrogen gas to the

substrate.

26. The computer readable recording medium according to claim 25, wherein said program causes said computer to control said substrate cleaning apparatus in such a way that in said process (d), only spraying of the nitrogen gas is stopped while moving the spray point of said nitrogen gas outward from the center portion of the substrate.

27. The computer readable recording medium according to claim 25 or 26, wherein said program causes said computer to control said substrate cleaning apparatus in such a way that a number of rotations of the substrate in said process (a) is set equal to or greater than 100 rpm and equal to or less than 1000 rpm, and a number of rotations of the substrate in said processes (b) to (d) is set equal to or greater than 800 rpm and equal to or less than 2500 rpm.

28. The computer readable recording medium according to any one of claims 21 to 26, wherein said program causes said computer to control said substrate cleaning apparatus in such a way that a number of rotations of the substrate in and following said process (b) is set greater than a number of rotations of the substrate in said process (a).

29. The computer readable recording medium according to claim 28, wherein said program causes said computer to control said substrate cleaning apparatus in such a way

that a number of rotations of the substrate in said
process (a) is set equal to or greater than 100 rpm and
equal to or less than 1000 rpm, and a number of rotations
of the substrate in and following said process (b) is set
5 equal to or greater than 1500 rpm and equal to or less
than 2500 rpm.